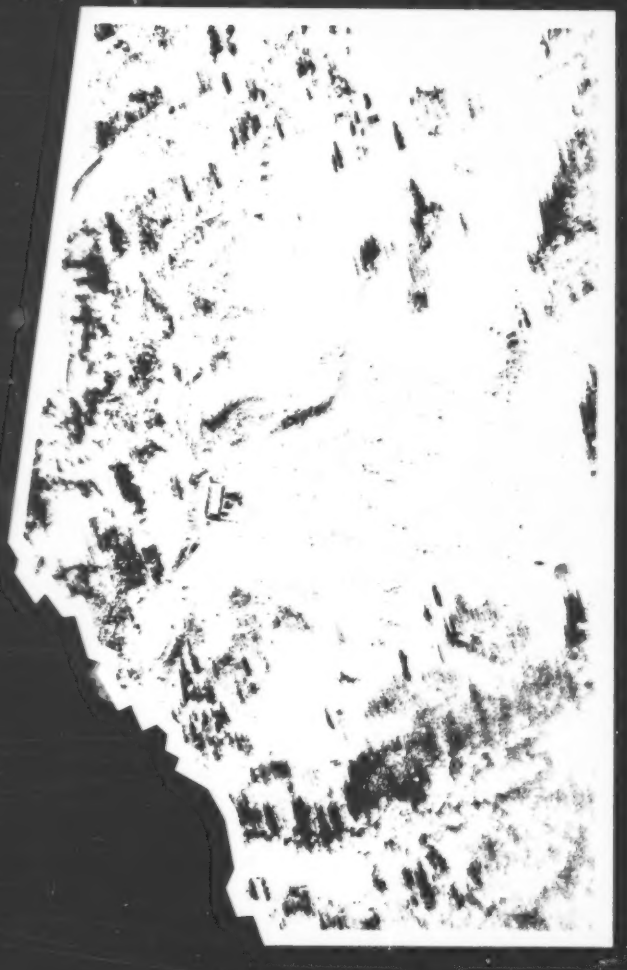
REMOTE SENSING

of an Historic Archaeological Site



Alberta
ENVIRONMENT

5.

REMOTE SENSING

OF AN HISTORIC ARCHAEOLOGICAL SITE: LILLE, ALBERTA

by

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ARCHAEOLOGICAL SURVEY OF ALBERTA

ALBERTA CULTURE

Alberta Remote Sensing Center

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DEMONSTRATION PROJECT

This is a remote sensing demonstration project sponsored by the Alberta Remote Sensing Center, Alberta Environment.

COVER PHOTOGRAPH

Lille Townsite, Gold Creek Valley, Alberta.
Black and White Infrared, A40079IR, Photo 16
6 October, 1978, Scale 1:4,000.

ABSTRACT

Beginning in 1978, a research investigation was carried out on the effectiveness of remote sensing technology for locating and interpreting the existence of historical resources. A limited range of remote sensing data was collected on one known historical resource, the Lille townsite. Following data collection and interpretation, a ground truthing survey of the site area was completed to examine the accuracy of interpretations by correlating remote sensing data with physical site features. The results of that survey, which included two test excavations, revealed successes and failures of the remote sensing programme. This report is a description of these results.

CONTENTS

	Page
ABSTRACT	i
CONTENTS	ii
LIST OF FIGURES	iii
INTRODUCTION	2
BACKGROUND	
The Historic Resource of Lille	2
The Technology of Remote Sensing	2
Physiographic Setting	2
THEORETICAL FRAMEWORK AND METHODOLOGY	
Remote Sensing	2
Ground Truthing	3
HISTORICAL RESOURCE DATA	
Feature Survey Sample	4
Archaeological Testing	7
CONCLUSIONS AND RECOMMENDATIONS	9
LIST OF REFERENCES	10

LIST OF FIGURES

Figure		Page
1.	Lille Townsite location	1
2.	Lille in the Gold Creek Valley	11
3.	View of Lille, circa 1906-1909	12
4.	Cultural features at Lille, overlay, pocket inside back cover	
5.	Color Infrared (2443) photo of Lille	13
6.	Black and White Infrared (2424) photo of Lille	14
7.	Feature 1, Test excavation in commercial complex	15
8.	Feature 22, Test excavation in residential area	15
9.	Feature 3, ridge	15
10.	Feature 8, platform remains	15
11.	Feature 14, large cellar depression	16
12.	Feature 16, house foundation	16
13.	Feature 18, linear construction	16
14.	Feature 21, depression and building foundation	16
15.	Feature 23, linear concrete feature	17
16.	Feature 24, log cabin construction	17
17.	DjPo 112-1B, excavation unit near hotel	17
18.	DjPo 112-22A, stone retaining wall	17
19.	DjPo 112-1A, B unit location in regard to hotel site	18
20.	DjPo 112-1B1, 2, south elevation view	19
21.	DjPo 112-22A 1 to 22 A5, west elevation view	20

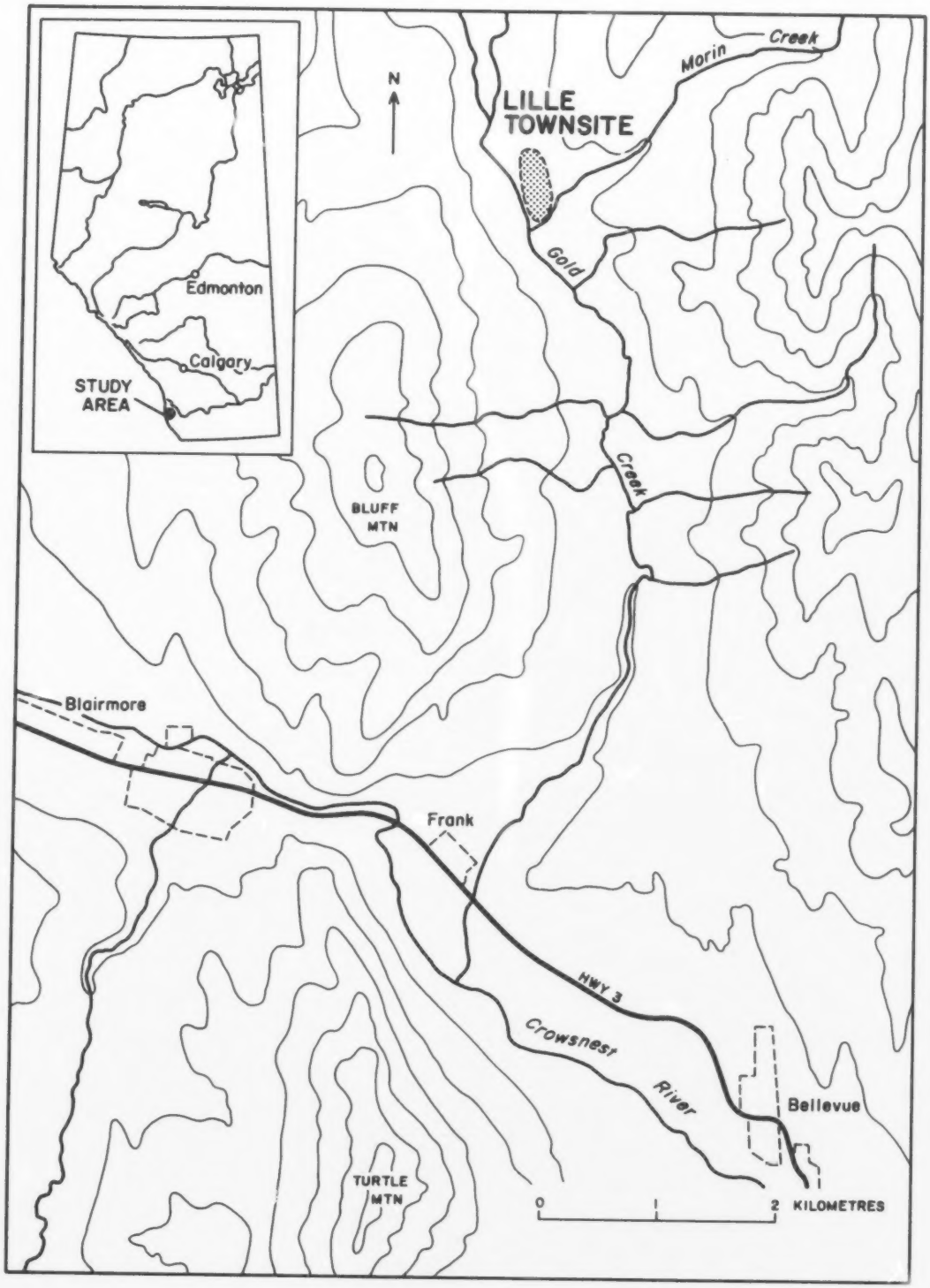

Fig. 1 Lille Townsite Location

INTRODUCTION

Interest in a remote sensing project for the Crowsnest Pass area was first expressed in communication between Dr. W.J. Byrne of the Archaeological Survey of Alberta and Mr. K.M. Campbell of the Alberta Remote Sensing Center (letter, KMC to WJB, 27/06/78). In a formal proposal the Lille townsite was selected for examination (04/08/78). The objective of the remote sensing project was to provide a data base for interpreting the existence and location of cultural features. A subsequent ground-truthing survey was to be carried out for the purpose of correlating interpretations derived from remote sensing information with visual observations made at the site itself.

BACKGROUND

The Historic Resource of Lille

The Lille townsite is designated as a provincial historic resource. Following the discovery of coal seams in the Gold Creek Valley circa 1901, mining began in earnest and the town of Lille was quickly established. The extractive industry was supplemented with a coking plant built of imported Belgian bricks. The town consisted mainly of cottages and a few small commercial enterprises. It was a small community, never more than 500 strong, and flourished briefly before dying out in 1914 (Reeves 1974). Most of the standing structures were removed or destroyed and, today, the most dominant ruins are those of the coking ovens.

The Technology of Remote Sensing

The use of remote sensing techniques, particularly the study of conventional black and white vertical aerial photographs, has long been considered an acceptable component of the tool-kit that archaeologists use in their search for prehistoric and historic site locations. Differences in vegetation cover, soils, hydrological characteristics and shadow markings result in tonal distinctions which the archaeologist uses as part of his equipment for interpreting the presence/absence or probable occurrence of historic resources.

More recently developed remote sensing technology has not been fully adopted by archaeologists, although its utility has been demonstrated for cultural resource management (Lyons and Avery 1977). In Alberta, the success of using the low oblique-angled aerial photograph for pinpointing the location of a historic site has been illustrated in a limited circulation manuscript (Steer 1976). Also attempted at the same site, Rocky Mountain House, was the use of multispectral photography and thermal infrared linescanning. This experiment was disappointing. In the failure of the Rocky Mountain House project, however, several problems were identified, including vegetation cutting, small scale, and poor timing. The promise of remote sensing techniques for conducting historic resources surveys and for having a role in cultural resource management should not be denied because of early negative results. In fact, such results serve to define the limitations of new technology and promote a base for continuing research until success is achieved.

Physiographic Setting

The Lille townsite is situated about 6 km north of Frank, Alberta, in a parkland basin of the Gold Creek valley (Fig. 1). Vegetation in the basin is characterized by open grassy areas and a mixed deciduous-coniferous tree cover. The Gold Creek valley is oriented north-south, with mountain ridges to the east and west (Fig. 2). The valley slopes are more predominantly covered by coniferous trees. In the townsite core, topsoil is poorly developed and in many places the underlying fluvial deposit of sands and gravels is readily apparent. There has been no evidence of flooding with attendant erosional or depositional influences in the main area of Lille since its construction and demise. Other disturbances, however, are evidenced by the presence of seismic cut lines, unplanned vehicular traffic across historic resources and holes excavated by relic collectors.

THEORETICAL FRAMEWORK AND METHODOLOGY

Remote Sensing

The remote sensing package to be used was determined by Kenneth M. Campbell, Alberta Remote Sensing Center:

A review of the available remote sensing archaeolcgical literature (Avery 1977), (Lyons and Avery 1977), suggests that identification of the cut stone foundations and root cellar depressions is probable stereoptically, provided that the imagery is recorded at a scale sufficiently large to be able to resolve the required minimum ground dimensions, (in this case six by eight feet).

The incursion of aspen/poplar stands into the townsite area will demand that any imagery obtained be acquired before spring leafout or after autumn senescence with no snow, so that the ground beneath the trees can be examined.

As the basic surface soil within the site is a sand/gravel/pebble composite mixture, photographic soil markings are unlikely unless construction activity of the period extended below this present top soil mixture and caused some top soil/subsoil mixing at the surface.

As the townsite is bounded on both east and west by mountain ridges, the low sun angles

required for shadow markings identification is not possible. Shadow markings, therefore, must be ruled out for this particular investigation.

Photographic positive and negative vegetation markings are likely, however, because of the differences in soil compaction and resultant deeper root penetration in disturbed soil areas. These markings could best be discriminated by the use of color infrared film. (Avery 1977), (Lyons and Avery 1977).

Buried structural features and man made drainage patterns are likely within this site and could best be discriminated by the use of black and white infrared film (Cameron 1958, Ediene 1956)."

In addition, it was surmised that the townsite transportation network, consisting of railbeds, wagon roads and streets could consist of a compacted sand/gravel/lignite mixture which could exhibit markedly different thermal inertia characteristics from that of neighbouring materials. If these properties existed, this network could be discriminated by an infrared thermal line scanner. In addition, a beneficial "extra" would be the increased capability to detect subtle differences in soil moisture and so reinforce the black and white infrared information.

It was recommended that multi-spectral imagery be acquired of the Lille townsite according to the following specifications:

Time Frame:
a. 15 October to 30 October
b. 15 April to 30 May

Altitude:
2,000 feet above ground level

Sun Angle:
No greater than 30 degrees from median

Sensor Package:
1. RC 10 camera, six inch lens equipped with Wratten 12 and Anti-vignetting filters, loaded with color infrared film (Kodak 2443).
2. RC 10 camera, six inch lens equipped with Wratten 89B filter, loaded with black and white infrared film (Kodak 2424).
3. Daedalus Infrared Line Scanner, calibrated to the 8-14 mu thermal window. To be flown simultaneously with sensors 1 and 2 and again in a predawn flight. (Two flights required).

Cloud:
Not more than 10% permissable

Funding for the project, in the amount of $1,239.00 covering the charges for flying the mission, photo reproduction and mosaicing by the Canada Centre for Remote Sensing and the National Air Photo Library - was paid for by the Alberta Remote Sensing Center. The project overflights were made in late October, 1978, rather than waiting until the following spring. The Canada Centre for Remote Sensing was responsible for imagery acquisition and the National Air Photo Library constructed a mosaic from the color infrared series.

Interpretation of the data was undertaken in late winter and spring, 1979. Extensive study was made of the black and white infrared and color infrared imagery. The color infrared data was used predominantly, as it seemed to be more useful for distinguishing the probable location of cultural features. A detail map was made of the townsite core. This map illustrated features which were interpreted as the indicators of Lille structures, ruins, subsurface water lines, roadways, and scenes of other types of human activity and construction.

Ground Truthing

Prior to carrying out a ground truthing survey, a search was made for documentary information pertaining to the townsite. No town plan could be located, but an oblique view of Lille, taken during its period of active existence, was discovered in the Glenbow Alberta Institute Archives. This photograph provided an earlier reference point for a preliminary check of our interpretations derived from remote sensing data. Rarely is such an opportunity available. Comparison of this photo to our map verified that features tentatively identified as structure foundations, cellar and privy depressions were what they appeared to be. Features observed on the remote sensing data have also, where possible, been correlated to the historic photo (Figure 3).

The ground truthing survey was carried out in June, 1979. Approximately 19 man-days were expended, by a crew of three, in carrying out the archaeological survey. About half of this time was spent in carrying out surface traverses of the area to correlate remote sensing interpretations with visually observable ground features, and to explore the area for historical resources not previously identified by examining the remote sensing imagery. A series of features were selected for photographic recording and commentary. Figure 4, an overlay depicting the cultural features of Lille, is in the inside back cover of this report. It should be used with Figures 5 and 6.

Archaeological test excavations were then undertaken at two locations in the Lille townsite. The selection of the test sites was undertaken following the completion of the ground truthing survey.

The purpose of the archaeological testing was to check the correlation made between interpretations derived from studying remote sensing data and on ground observations. It was therefore essential to choose two features which were visible on the air photos, rather than features which had been discovered only by ground truthing.

It was recognized that test excavations of a wide variety of features interpreted by remote sensing and ground truthing would be desirable. The initial scope and resources of the project were not equal to such a goal, but it was possible to test two features. The selection of the two features was based on judgemental values. The underlying rationale was that the two features should be located in different areas of Lille reflecting interpreted functional and structural distinctions.

One of the features selected for testing was located in the area of large foundations which was interpreted as forming the industrial-commercial-administrative component of Lille. Specifically, a test site was chosen at the edge of a terrace near the hotel foundation (Feature 1). The test unit was designated DjPo 112-1A* (Fig. 7). The purpose of this test was to determine the depth of the cultural deposit, and the nature and extent of disturbance. A part of the unit was disturbed at the surface and part was undisturbed.

The second feature selected for testing was located in the large area characterized by rectangular foundations and circular depressions which was interpreted as forming the residential component of Lille. A circular depression feature (Feature 22) was chosen, and the test unit oriented to cut a sectional profile through the depression. The test unit was designated DjPo 112-22A (Fig. 8). The purpose of this test was to determine the depth of cultural material, some attributes of the feature including possible function and to determine if recent disturbance had occurred.

HISTORICAL RESOURCE DATA

Feature Survey Sample

As a matter of interest, there was also an attempt to cross-correlate structures visible in the historic photo to recognizable cultural feature indicators on the modern air photos. While there are at least four structures or features indicated on the air photos which are not represented on the historic photo, they may relate to construction activity after the picture was taken circa 1907. Of greater interest, and more problematic significance, are the structures visible in the historic photo and indicated by the letters A-E but which have left no traces apparent from the modern air photos. Neither could the building foundations be located during the surface survey. It is possible that remains of the structures were obliterated or covered over during the site abandonment process. Questions on the presence/absence of archaeological materials relating to these structures may only be resolved by excavation.

During the ground truthing survey 24 features were selected for individual reportage, although a far greater number were physically examined. This sample is reported in sequence, the sequential number keyed to the historic photo (Figure 3) and the overlay (Figure 4) for the air photos, for location reference.

Feature 1:

The hotel foundation (Figure 7) is one of the more prominent ruins of Lille. Constructed of cut stone and mortar, the foundation is easily visible from the main area of the townsite. Situated in an open area and on the edge of a terrace, the feature is extremely well defined by shadow markings on the 2443 and 2424 film.

Feature 2:

The remains of a wooden frame (3.67 m NW-SE x 2.50 m NE-SW), possibly for a platform or floor, were found immediately NE of two depressions at the base of the terrace slope. The overall outline, rather than the framing material (5 cm x 10cm), was barely discernible on 2424 film but was slightly more distinguishable on 2443. The feature is of doubtful historic significance and is not apparent in the historic photograph.

Features 3 and 4:

These two features could be discriminated on both photographic films. Feature 3 on 2424 was represented as a straight line through a small clearing, with some shadow marking on the NW side, indicating a low ridge configuration. A loosely spaced row of immature coniferous trees appeared to be growing to the NW side of the ridge. This may be due to better moisture retention along one side than another. The NE end of the linear construction appeared to terminate in a mature stand of deciduous trees, but this could not be verified from the air photos because of the dense shadows cast by the vegetation.

On 2443 film Feature 3 was still more observable. The very highly reflective white tone of the ridge side catching the sun's rays suggested a well drained formation, possibly of gravel, with little vegetation cover. Vegetation on this side could consist of matured and dead grasses.

Feature 3 was interpreted as a definite cultural manifestation, but no function could be ascribed. Although strikingly apparent throughout the extent of the clearing, the feature was lost in the woods at each end.

Feature 4 was also visually observed on both 2424 and 2443 film. The west end was curved and seemed to terminate with one end of the linear construction. Much of the curved feature was visually lost in the tree cover

* DjPo 112 is an archaeological designator for Lille based on the Borden system, a nation-wide means of identifying archaeological site locations.

and shadows at each end. A cultural interpretation was not given to Feature 4 prior to field investigation.

Features 3 and 4 were easily located in the field. Both were constructed of stone cobbles and gravel. Feature 3 is circa 1.50 m in height (Fig. 9). The elevation of the land surface on the upstream (north and west or shadow side) side is higher than on the downstream side. Fine coal particles were conspicuously present on the ground surface of the higher side. The feature continued into the woods and formed right-angled extensions towards the upstream side.

Feature 4 is circa 1.75 m in height, and similar in construction to that described above. Feature 4, however, forms a semi-circular curve that continues well into the trees. A breach in the ridge has been caused by erosion.

Both of the features, following field investigation, were interpreted as dikes constructed to prevent coal dust and particles from washing down-slope and into Gold Creek.

Feature 5:

Initial study of the remote sensing data did not result in discovery of this feature. Stone foundations with heavy bolts embedded, possibly for a structural base of stationary engine mount, were found in a clump of deciduous trees. Subsequent re-examination of 2443 film was inconclusive, but there was some suggestion of the feature on 2424 film.

Feature 6:

Feature 6 was a large wooden structure visible in the historic photograph. There was no physical evidence for this building either on the remote sensing data or on the ground.

Feature 7:

Remote sensing data indicated the presence of a large, elongated depression north and east of the coking ovens. The depression was interpreted as a possible cultural feature that might have been excavated in connection with early townsite activity. Easily located on foot, Feature 7 may have been caused by natural erosion.

Feature 8:

Between the depression and the coking ovens another feature was indicated on both 2424 and 2443 film. The most distinguishing attribute apparent consisted on a series of thin parallel lines oriented on an axis trending NW-SE. The lines were considered to be shadow markings. No speculation was made on the material, structure or function of the object responsible for the visual pattern. On 2443 film, grey and blue-grey color tones were noted in the areas of Feature 8. These same colours were observed to occur in other areas of the coking complex and in front of the hotel. These colours were broadly interpreted as the result of reflected light from a possible combination of materials: coke, coal cinders and coal mixed with ash. The feature was interpreted as extending well into deciduous tree cover to the southeast.

Upon field inspection, the feature did not appear to extend as far to the southeast as interpreted from the air photos. Feature 8 represented the remains of a large, wooden platform structure (Fig. 10). Numerous upright posts, spaced at regular intervals, supported timbers running NW-SE. These ruins probably cast the shadow markings of parallel lines visible on the air photos. The timbers served as joists for overlying planking, as suggested by several rotten fragments. The grey tones apparent on the 2443 film were represented by large deposits of coke waste.

The historic photograph illustrates the appearance and construction of the wooden platform. The platform is raised above the level of the railroad tracks on either side.

Feature 9:

On 2424 film, a small area NW of the coke ovens had a stippled effect similar to that near the coke ovens themselves. The 2443 film, however, was predominantly white in the same area, but still retained a grey stippled impression. The feature was interpreted as a possible rubble pile, as no structure could be inferred. During ground inspection, this area was found to be littered with coking oven bricks. The remains of a large wood floor were also present.

A large shed-roofed structure, visible in the historic photo, corresponds to the location of Feature 9.

Feature 10:

An L-shaped structure, possibly a building foundation, was plotted NW of the coking ovens. This assessment was based on air photo interpretation. The outline of the foundation was defined by a linear depression and shadow markings. Ground truthing failed to reveal any evidence for this particular configuration, or any other historical remains. The historic photograph provides some conflicting evidence. A long, gable-roofed structure is present in the approximate location of the one plotted by studying remote sensing data. The shape of the building, however, is not the same. In addition, the structure appears built on short piles and it is doubtful if this construction method could be responsible for the interpreted pattern.

Feature 11:

Feature 11 is a roughly circular depression, 2 m in diameter and 1.25 m deep. It is located in deciduous tree cover north of the plotted feature 10. The existence of the depression was not discovered until the

ground truthing survey. The function of the depression was not ascertained.

Feature 12:

A major stone foundation, mortared, and with a depressed interior was located during the ground truthing survey. The foundation had not been recognized during the prior remote sensing interpretation period. Following the field season, re-examination of both 2424 and 2443 film clearly indicated the presence of this structure. Two of the foundation walls and part of the third are suggested by tonal differences and shadow markings. The function of the structure is unknown.

Feature 13:

This feature, also, had not been previously identified through study of remote sensing data. The small depression constituting the feature was located NE of an interpreted house foundation with cellar. A cultural interpretation was ascribed to the depression because of its size, proximity to a house foundation and symmetrical relationship to other features in the area. Immediately to the NE of the feature, and in a small clump of deciduous trees, was a small surface scatter of bricks and stones.

Feature 14:

Feature 14 consists of a large cellar depression and house foundation outline. Visible on 2424 and 2443 film, shadow markings were the most important means for delineating the extent of the feature. Several trees were growing out the cellar depression. Strong shadows cast by these, and other nearby trees, obscured a completely clear definition of the low linear ridge characterizing the foundation outline.

Ground truthing revealed that the foundation outline consisted of cobbles with a light covering of grass (Fig. 11). Window glass fragments, bricks and some wood remains were found throughout the foundation area.

Feature 15:

A shallow surface depression and low coal/refuse pile were located circa 9 m NE of Feature 14. Feature 15 was apparently associated with the house but had not been recognized during the air photo study. Subsequent re-examination of the air photos revealed the shallow depression but not the refuse scatter.

Feature 16:

Feature 16 was equally visible on 2424 and 2443 film. The main part of the feature consisted of a large rectangular foundation and depression. A smaller rectangular and adjoining foundation was also observable. The feature was very distinct because of the shadow markings. Deciduous trees to the north and west obscured only part of the neighbouring ground surface. A narrow linear depression, trending NE-SW, was visible through the tree cover. On 2443 film, blue-grey tones to the NW of the foundation were also visible through the overgrowth. This was interpreted as a surface deposition of coal cinders and ash.

During the ground truthing survey, the large foundation was found to be constructed of stone (Fig. 12). The smaller adjoining foundation was of concrete. The linear depression was also located. The observed grey tones outside the house were found to represent a coal-cinder-ash deposition. Much coal and ash were also noted to occur inside the large house depression, but had not been observed prior to field inspection.

Feature 17:

A large square-shaped area, east of Feature 16, of grey tone and colouration was observed on the air photos. This feature, no. 17, also appeared to form a flat mound slightly higher than the adjacent terrain. Coal was the inferred material composing the mound. Only a bit of grass was covering the feature. Feature 17 was interpreted as the possible base for a large structure.

The field evaluation differed only in regard to the concluding interpretive comment. In the absence of structural and artifactual remains, it was decided that the mound definitely did not form a building foundation.

Feature 18:

Several long linear features were noted during the study of the air photos. All lines were visible on both films. Feature 18 is one line running roughly NNE-SSW and across the center of the townsite. Shadow markings and vegetational distinctions contribute to the delineation of this feature. In some places the line is characterized as a narrow, shallow trench and in others as a low ridge. Small deciduous shrubs have grown directly over the line at some locations. This attribute has produced some tonal and color differences on both films in the form of positive and negative crop marks, but are not as easily recognizable as shadow marks. Feature 18 and other narrow linear features were interpreted as indicating the presence of backfilled trenches excavated to accommodate water lines (Fig. 13).

All other linear features were easily located during the ground truthing survey. No evidence was discovered which could confirm or deny the prior interpretation.

Feature 18 was partly visible on the historic photograph.

Feature 19:

Feature 19 was located only by the ground truthing survey. A small circular depression was discovered west of a dilapidated log cabin structure. The log cabin was easily visible on the air photos,

but not the shallow depression. This feature could not be conclusively located during subsequent re-examination of the air photos because of the strong shadows cast by the log cabin ruins and adjacent deciduous tree cover.

Feature 20:

Three, and possibly four, small surface depressions were located north of the log cabin ruins. The depressions occurred in direct line with the northern end of Feature 18. None had been plotted during the initial air photo study period; they were all discovered as a result of ground survey. No function for the depressions was interpreted. The three more prominent depressions were observed as shadow markings in the follow-up restudy of the air photos. The possible fourth depression was obscured by the coniferous tree shadows cast over the northernmost end of Feature 18.

Feature 21:

Feature 21 consists of mixed attributes: a dark charcoal coloured stain, a large oval depression, and raised linear construction. The linear construction was interpreted as part of a building foundation, but the complete perimeter was not completely definable. The west foundation line and the associated depression were both interpreted on the basis of this configuration as defined by shadow markings. The depression was interpreted as indicative of a cellar within one wing of the building. The circular dark stain located nearby was considered to represent an area of coal and cinder deposition. The pattern created by the complex of attributes was dissimilar to those in the rest of the townsite that had been interpreted as house remains. The function of Feature 21 was not interpreted.

The outline of Feature 21 was no more easily defined during the ground truthing survey than on the air photos. The structural perimeter was indicated by lines of stones. Although fragments of artifacts were found to occur in the area of coal deposition, no function for the structure was inferred (Fig. 14).

A large L-shaped building, visible on the historic photograph, corresponds to the same location as Feature 21. The building was speculatively interpreted as a worker's bunkhouse/boardinghouse.

Feature 22:

Feature 22, and many others like it, was easily visible on both films. The feature was identifiable as a circular, shallow surface depression defined by shadow markings. There was also less vegetation within the confines of the depression than on the surrounding meadow. This feature was interpreted as a privy depression.

Ground truthing quickly located the depression. There were numerous stones, fragments of lumber and considerable quantities of artifactual debris, particularly tin cans, in and around the feature (Fig. 8).

Review of the historic photograph revealed that small sheds and privies corresponded to the locations of the circular depressions, including Feature 22.

Feature 23:

Feature 23 consisted of several distinct elements. All were situated close together and in a clearing, but were only discovered by field investigations. One of the components was a small (4 m x 4 m) square-shaped mound. Apparently this was some sort of structural platform or base of concrete. Nearby was an 8 m long rectangular concrete structure, similar to a deep trough, set into the ground surface (Fig. 15). Also nearby were some wood remains, possibly forming another platform, about 5m x 5m in size.

Subsequent re-examination of the air photos indicated that the clearing in which Feature 23 was located is hidden by deep shadows cast by mature deciduous and coniferous trees along the stream channel.

Feature 24:

A small log cabin style feature was located by the ground survey that had not been previously recognized by air photo studies (Fig. 16). The structure was rectangular in overall form and 2 and 3 logs in height. The feature was located in deciduous trees at the edge of coniferous cover and against the slope of a small hill. The log outline was about 7 m x 5 m.

Re-examination of the air photos failed to reveal the feature, although 2424 film seemed to provide better shadow penetration.

Archaeological Testing

DjPo 112-1A,B: Excavation at Feature 1 was to consist of a 1 m x 2 m test trench, and was to be excavated in two parts (Fig. 19). The eastern 1.3 m of the trench was designated DjPo 112-1A, corresponding to the undisturbed terrace part of the unit (Fig. 7). For ease of excavation, the western .7 m of the trench, designated DjPo 112-1B, was first excavated. Owing to the unexpected depth of the deposit and, ultimately, shortness of time, DjPo 112-1A was not excavated.

DjPo 112-1B was excavated into a deposit of cultural material sloping away from the edge of a terrace located west of the hotel ruins. The existence of a cultural deposit at this location was first interpreted by studying the color infrared imagery. On this film, the deposit had a blue and white color which could not be attributed to a natural feature or condition.

Ground truthing was more fully able to assess the nature and quality of cultural deposits along the edge of the terrace. The

slope away from the terrace edge appeared to be entirely of cultural origin. The slope consisted of cinders, ash, coal and coke fragments, and artifactual debris. The nature of the deposit, the steepness of the slope and periodic disturbance by pot-hunters has prevented vegetation from covering the deposit. Most of the artifactual debris was highly fragmented and could not definitely be assigned to the known period of site occupation. It was broadly assumed, however, that the deposit was associated not just to site occupation but, more specifically, to a functioning hotel enterprise.

Excavation was carried out by shovel and trowel with all of the matrix passed through a mechanical sifting screen to recover the artifacts. The unit was subdivided into two excavation levels (Fig. 20). Level 1 was extended from the ground surface to 80 cm below ground surface, measured on the east wall of the unit. Few artifacts were present in this level.

The cultural deposit was fairly homogeneous, consisting of ash, cinders and coal fragments. DjPo 112-1B2 extended from 80 cm below ground surface to 1.3 m below ground surface. Sterile soil was encountered through the bottom 30 cm of this level, which also marked the limit of excavation. The sterile soil was identified by the original ground surface which appeared as a 2 cm thick black soil (sod horizon overlying a brown soil). This surface also sloped downwards away from the hotel site.

DjPo 112-1B2 was considerably distinct from the upper excavation level. DjPo 112-1B2 was characterized by a greater frequency of artifactual materials and cobbles overlying the old ground surface than was contained throughout the entire overburden deposit. The artifacts, also, were less fragmentary and more diagnostic. Many of the objects represented liquor containers. One of the containers, marked "R & Co" was considered to date from 1880 to 1900 (Toulouse 1972:439), and probably was a beer bottle. This type of artifact has been found in other Alberta late nineteenth and early twentieth century contexts (Adams, Forsman and Minni 1977:296); Hand-finished bottle fragments were also recovered from this level and are compatible with an early twentieth century interpretation.

Much of the excavation unit was fairly homogeneous in composition throughout and there was no stratigraphic evidence for disturbance continuing below the ground surface. No recent deposition was noted on the unit surface (Fig 17). Consequently, it is inferred that much of the cultural deposit along the edge of the terrace is deep, uncontaminated by recent deposition activity, and relatively undisturbed. The cultural debris is still attributed to hotel activity, although there are two distinct phases to the deposition process.

The cultural deposit investigated by this test pit is a cultural resource having considerable research potential. The materials contained therein, and difference in the character of their deposition are of interpretive significance for this part of the commercial site area, particularly as that relates to initial site usage and the subsequent construction and occupational activities of the hotel itself. Excavation contributed information not available by any other means, and remote sensing was important in first identifying the presence of a cultural deposit at this location.

DjPo 112-22A,22B: Excavation at Feature 22 (Figs. 4, 8) was intended to provide a sectional profile through the center of the depression. The unit was oriented along an East West axis and was 2 m x 1 m in horizontal extent. A scattering of cultural debris, including rotten board fragments, tin cans and broken bottles, littered the surface of the depression. Some of these items were of recent depositional age (eg. untarnished brass .22 caliber cartridge shell), still others of indeterminate age (rusty tin cans) and at least one artifact may have dated to site occupation (rim lock fragment). Due to the mixed nature of these items, all were raked to one side and not collected. Sparse grass vegetation covered the feature. At an early excavation stage, the straight walls of the depression feature were revealed. As the feature may have had some depth, and there was some potential for discerning backfill phases, excavation levels were employed. Excavation was by shovel and trowel with all excavated matrix screened.

The five culture-bearing excavation levels, DjPo 112-22A1 through 22A5, have been superimposed on the section view, Figure 21. Although a variety of artifacts were recovered, the only two dateable objects with a narrow time range were ceramic artifacts from DjPo 112-22A2. One of the artifacts, a brown colored earthenware teapot, was marked "ROYAL SEMI PORCELAIN DUDSON-WILCOX HANLEY ENGLAND", made by Dudson Wilcox & Till Limited, Britannic Works, Hanley Staffordshire Potteries and dates between 1902 and 1926 (Godden 1964:223). Crossmending fragments from this specimen occurred from levels DjPo 112-22A1 to 22A4. Crossmends between the same levels for other artifacts also were observed. The other narrowly dated artifact was a white earthenware bowl base (DjPo 112-22A2-33), marked "ROYAL IRONSTONE CHINA JOHNSON BROS. ENGLAND" made by Johnson Bros., Ltd., between 1883 and 1913 (Godden 1964:355).

Most of the artifacts were recovered from the first four levels. The fifth level contained brown soil, stoney fill with large ash deposits, some organic remains, possibly privy deposit use fill and a few artifacts (two brown glass fragments). The maximum depth of the cultural deposits was 1.5 m below ground surface. Excavation extended an additional 25 cm into sterile gravels.

Unstable cultural deposits formed the south side of the unit and persistent slumping necessitated their eventual removal.

Consequently the entire excavation unit was extended horizontally an additional 40 cm southwards. There were no levels to this extention, but all cultural materials collected from this matrix were given the designation DjPo 112-22B.

On the south and west sides of the depression feature, the walls were steeply in-sloping towards a level floor. These two walls consisted of the natural gravel deposits which form the main townsite terrace. The north wall, of course, cut a profile through the remaining cultural deposits in the depression. The east wall, however, was characterized by a dry-laid stone retaining wall. The stones were not removed as a part of this excavation (Fig. 18).

Feature 22 probably represents a privy depression. Little material, however, could be attributed to the period of active use of the feature. During the abandonment phase of occupation, the depression was rapidly backfilled as indicated by the presence of several crossmends throughout levels 1 to 4. The debris included a variety of objects compatible with the period of site occupancy. In terms of functional distinctions, perhaps the kitchen group ceramics of Feature 22 reflect a slightly more residential character than those from the hotel feature.

Further excavation in Feature 1, and excavations of other features similar to Feature 22 would be needed to confirm respective similarities and differences in the nature of the cultural deposits thus far recovered.

CONCLUSIONS AND RECOMMENDATIONS

An earlier researcher has pointed out that "...aerial photography can serve the archaeologist with special effectiveness in the realms of environmental survey and analysis, exploration for sites, expedition planning, site mapping and evaluation, and heuristic display" (Harp 1975:98). Harp also recognized the usefulness of air photos for post discovery analysis, interpretation and illustration. In this investigation we have been concerned with testing the usefulness of primarily two kinds of remote sensing imagery - black and white infrared film, color infrared film - with regard to determining the existence of historical resource features. Concluding comments on the general successes and failures, problems and possible recommendations for their solution can now be summarized.

The black and white infrared film (2424) was less useful than the color infrared film (2443) for detecting the presence of historical resources. The advantage of 2443 was evident in color and tonal distinctions used to interpret the presence of certain kinds of cultural deposits, as in the case of debris below Feature 1, the hotel site. The major difficulty experienced with studying both films is that they were unable to penetrate the deep shadows cast by coniferous trees. This was particularly evident in the failure to detect Feature 23, a concrete linear construction and associated mound which were in an open, grassy area. There is no doubt that this complex would have been visible by color distinction and shadow markings if it had been in an area receiving direct sunlight. Other features also went undetected, but these were sometimes small in scale and/or located in areas of tree cover. It was recognized from the beginning that vegetation cover could create problems:

"Right from conception, the requirement to record this area during the leaf off time frame was recognized. Because of the remoteness of the site, it was not possible to visit the site and assess the degree of deciduous senescence on a day by day basis. Accordingly, a project date-time window was selected based on the historical record. In actual fact, this was 14 to 21 days prior to complete senescence in the area. With this healthy vegetation canopy covering various parts of the site, it is hardly surprising that this canopy and its accompanying shadows, would obliterate significant areas of the area of interest. In addition, the blocking out of ground detail in shadow covered areas is a known characteristic of both the film types selected for use on this project. The result, however, would have been far less disastrous if the leaf off condition referred to above, could have been met. A potential detour around this problem would be to include Aerocolour film in any future camera cluster which is much more tolerant in shadow obscured areas". (Ken Campbell, personal communication).

Only in one instance was the conjectured existence of a feature, Feature 10 (based on air photo analysis), not adequately verified by ground truthing. The perceived feature may correspond to one seen in the historic photo, although the apparent characteristic of each do not match nor are any corresponding remains or features visible on the ground surface. This problem could potentially be resolved by archaeological excavation.

Two features, nos. 4 (a dike) and 12 (a structural foundation), were only recognized as cultural manifestations during the ground truthing survey. The features were, in fact, visible on the remote sensing data and should have been identified during the pre-field air photo analysis phase. This problem can be attributed to inexperience with air photo interpretation and can be corrected with greater practice.

Subsequent to the completion of the fieldwork, the imagery produced from uncorrected and unenhanced thermal line-scanning data was examined in an attempt to discern cultural features which were not visible on the air photos but all too evident on the ground. Of particular interest were Features 23 (a concrete construction) and 24 (a log structure)

because of their location and size. In addition, the shallowly buried stone wall of Feature 22 should also have been detectable. The attempt was generally frustrating and inconclusive because the feature locations could not be correlated with sufficient precision to the line scanning data such that the features could be searched for with confidence.

In summary, the most useful technique for determining the presence of historical resources was by examination of shadow markings for pattern regularities and shapes which could be interpreted as due to a cultural activity such as construction, debris deposition, etc., rather than to a natural feature such as an old river terrace or beaver dam. The location of these features can certainly be plotted more easily from air photos than from ground survey. Ground truthing and archaeological testing, however, are still needed as these methods definitely provide information not otherwise available.

The potential of remote sensing must be to provide indications for the presence of historical resources in lieu of intensive foot surveys. This potential has yet to be fully realized and there clearly needs to be a programme of continuing exploration and refinement of technology and procedures if this goal is going to be attained. Lower flights should detect smaller features. Different films might penetrate the shadows better. Continued research with thermal scanning data should enable us to detect features known to exist but which continue to elude. Only through collaboration among researchers and assignment of considerable priority to such endeavour can significant advances be achieved.

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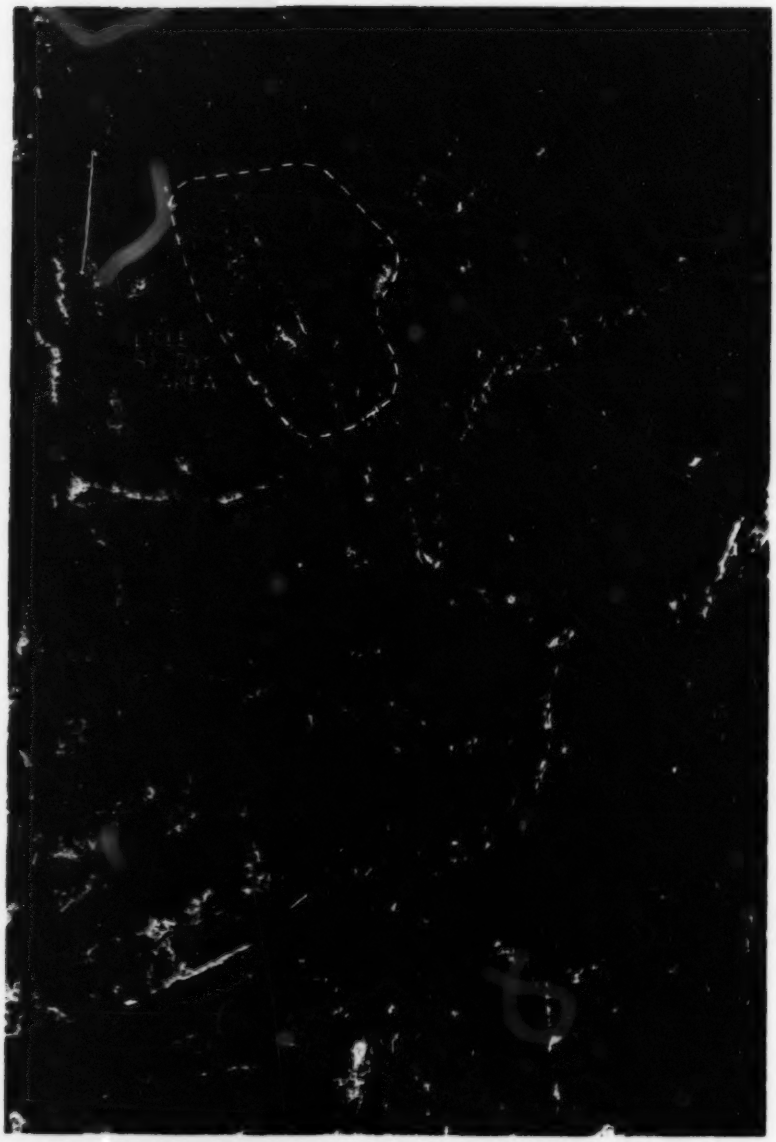


Fig. 2 Lille in the Gold Creek Valley
Black and White, AS 1178, Photo 261
29 June, 1972, Scale 1:21,120

Fig. 3 View of Lille circa 1906-1909
Courtesy of Glenbow Alberta Institute
No. NA-2197-1

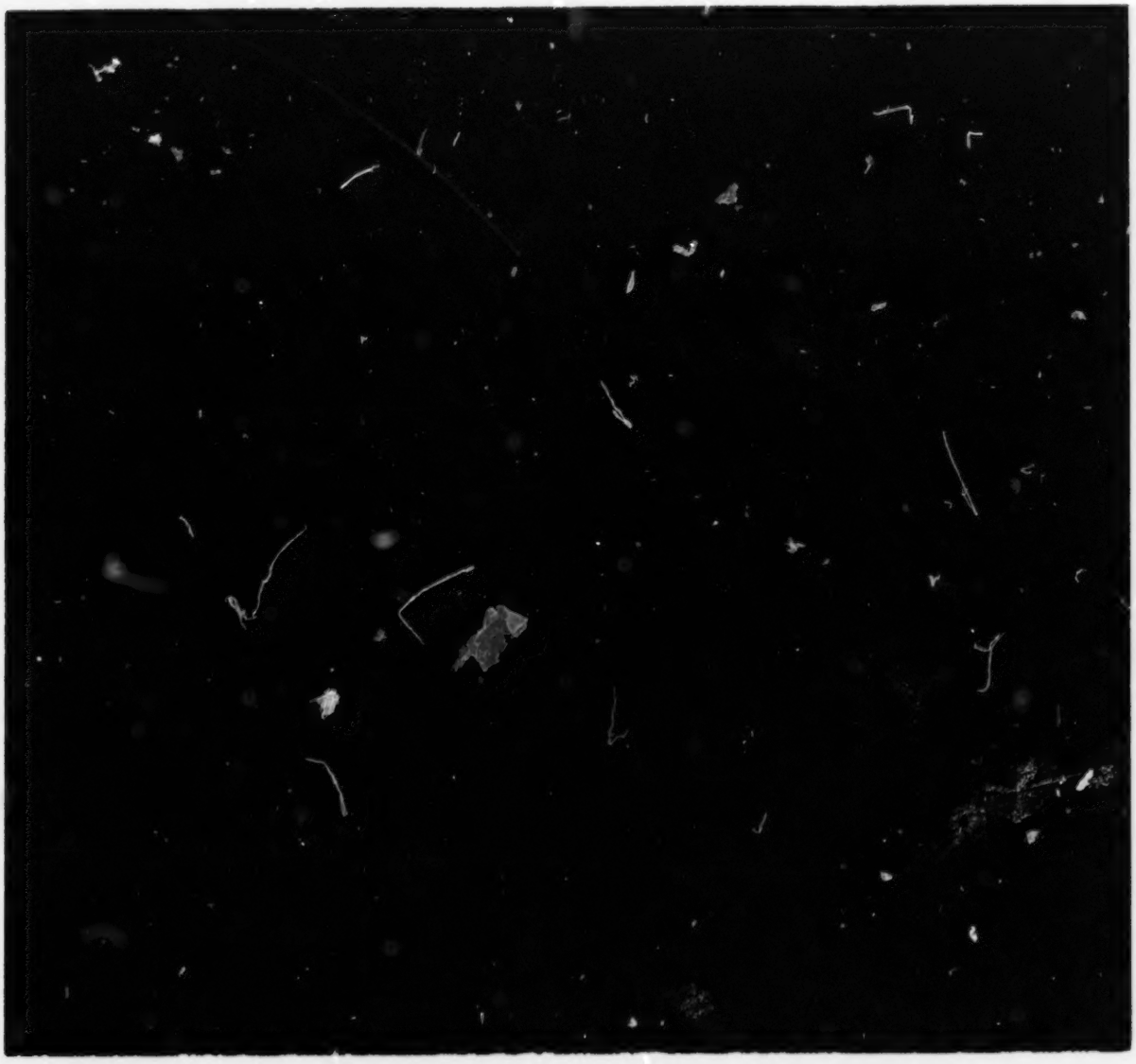


Fig. 5 Lilie Townsite, Color Infrared (2443)
A37760 IR, Photo 16, 6 October, 1978
Scale 1:4,000
(use overlay, Fig. 4, inside back cover)

Fig. 6 Lille Townsite, Black & White Infrared (2424)
A40079 IR, Photo 16, 6 October, 1978
Scale 1:4,000
(use overlay, Fig. 4, inside back cover)

Fig. 7 Feature 1, test excavation in commercial complex

Fig. 8 Feature 22, test excavation in residential area

Fig. 9 Feature 3, ridge

Fig. 10 Feature 8, platform remains

Fig. 11 Feature 14, large cellar depression

Fig. 12 Feature 16, house foundation

Fig. 13 Feature 18, linear construction

Fig. 14 Feature 21, depression and building foundation

Fig. 15 Feature 23, linear concrete feature

Fig. 16 Feature 24, log cabin construction

Fig. 17 DjPo 112-1B excavation unit near hotel

Fig. 18 DjPo 112-22A stone retaining wall

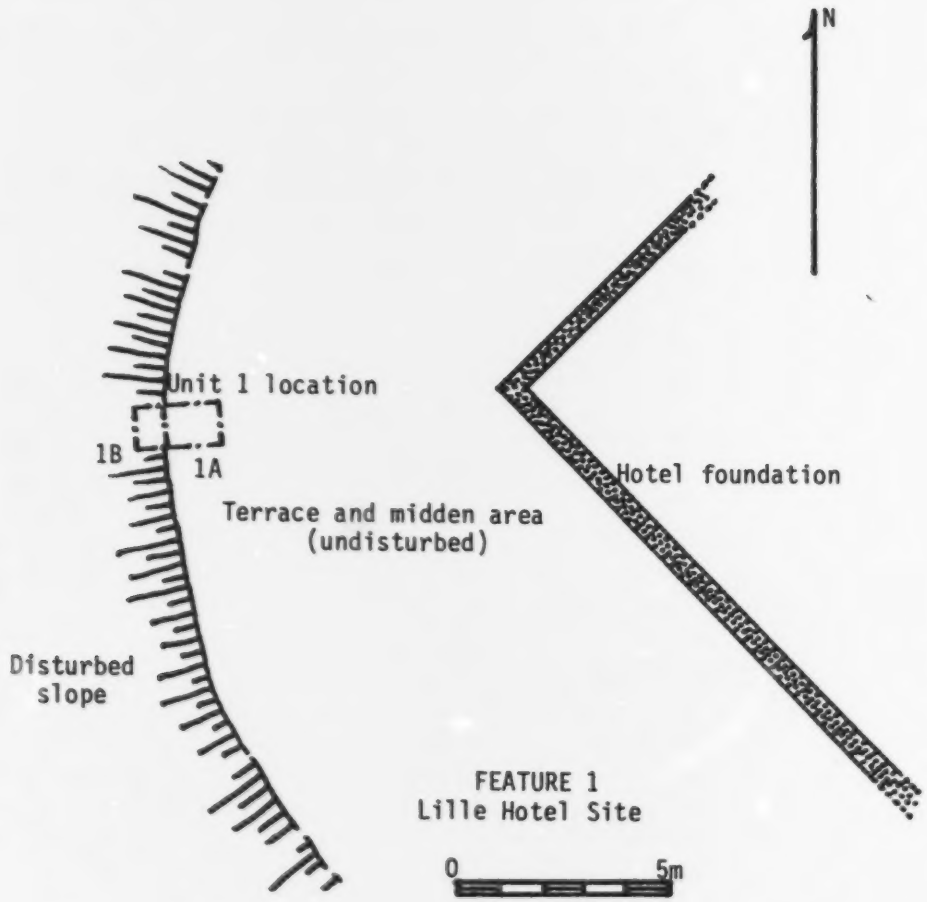
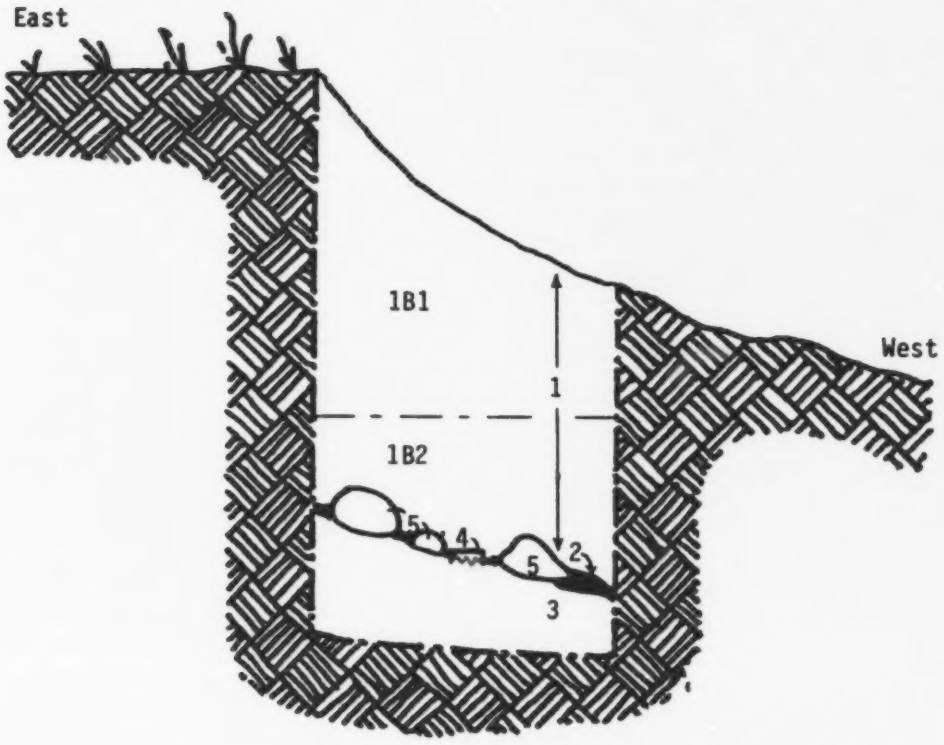


Figure 19. DjPo-112 - 1A, B unit location in regard to hotel site.



DjPo 112 - 1B1,2
South Elevation View

LEGEND

1. Ash, cinders, coal fragments.
2. Soil horizon at date of initial occupation.
3. Sterile subsoil.
4. Bottle base.
5. Rocks.

0 50cm

Figure 20. DjPo 112 - 1B1, 2; South Elevation View

DjPo 112 - 22A1 to 22A5
West Elevation View

LEGEND

1. Grey-brown fill, contains cultural material, coal slag, stones.
2. Brown soil and stoney fill with cultural material.
3. Brown soil and stoney fill with large ash deposits, some orangic remains, few artifacts. Possible privy deposit use fill.
4. Grey, clayey gravel deposit, sterile.
5. Iron pipe.

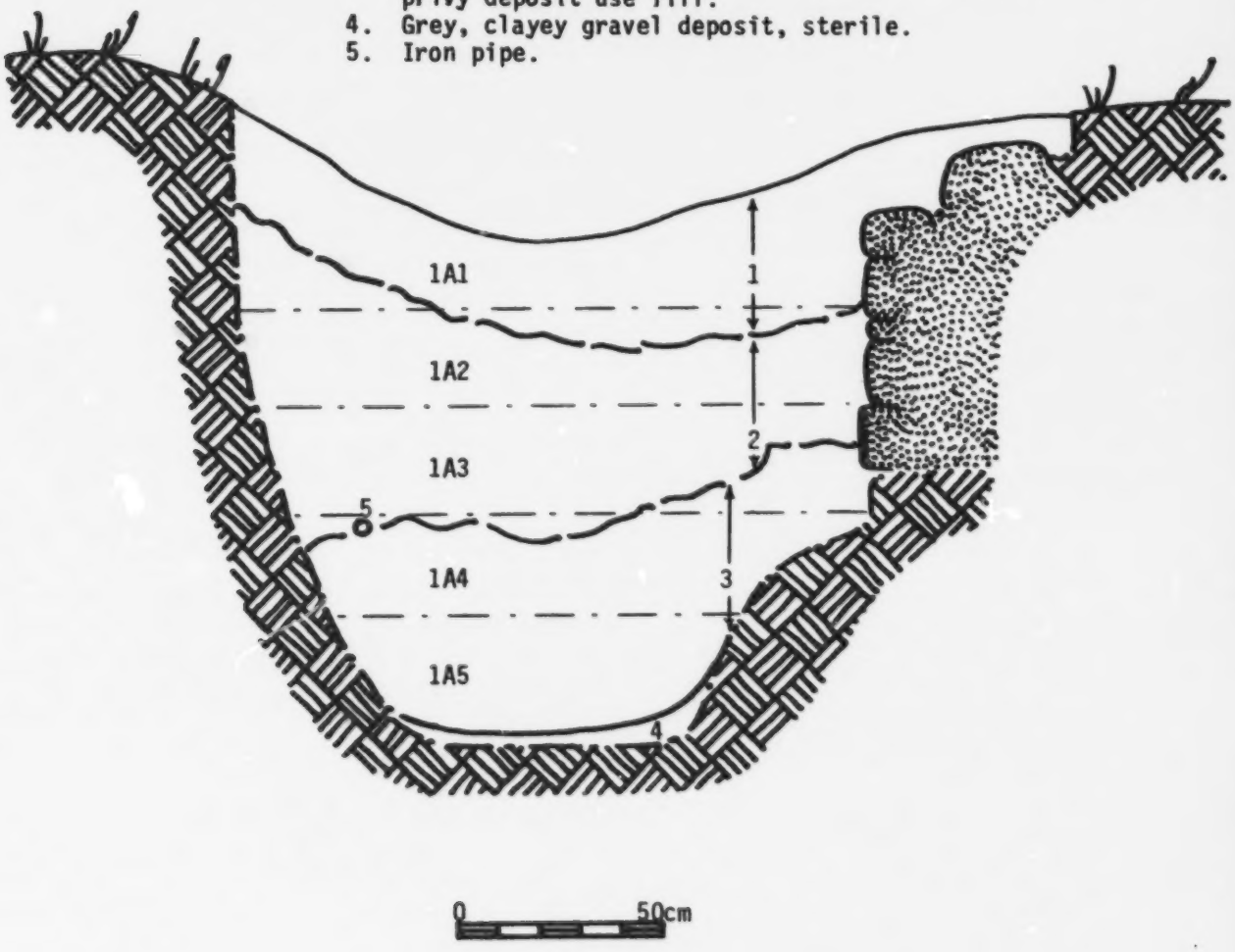


Figure 21. DjPo 112 - 22A1 to 22A5, West Elevation View.

Figure 4. Cultural features at Lille
(use with Fig. 5 and 6)